

DETAILED ACTION

Status of the claims

Claims 27-54 are currently pending. Claims 1-26 have been canceled by Applicant. Claims 33-44 and 46-52 have been withdrawn pursuant to a restriction requirement, as discussed in the office action dated 03/05/2009. Claims 27-32, 45, 53 and 54 are currently under examination.

All rejections and/or objections not explicitly maintained in the instant office action have been withdrawn per Applicants' claim amendments and/or persuasive arguments.

The U.S. effective filing date has been determined to be 04/14/2003, the filing date of the document PCT/EP03/03838.

Rejections

Claim Rejections - 35 U.S.C. 112 - First Paragraph

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

- 1. Claims 31 and 32 remain rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the**

time the application was filed, had possession of the claimed invention. This is a Written Description rejection.

M.P.E.P. § 2163 states, "An applicant shows possession of the claimed invention by describing the claimed invention with all of its limitations using such descriptive means as words, structures, figures, diagrams, and formulas that fully set forth the claimed invention...one must define a compound by 'whatever characteristics sufficiently distinguish it'... A lack of adequate written description issue also arises if the knowledge and level of skill in the art would not permit one skilled in the art to immediately envisage the product claimed from the disclosed process."

Instant claim 31 recites, --P is an effective group--, however no structure or formula is given for said effective group(s). The instant Specification provides the guidance as to what an effective group is:

--The expression "P is an effective group" means that P is a group which can confer new physical, chemical or biological properties to the carbon nanotube which carries it.--(p.10, last two lines; PG Pub [0063])

The specification offers guidance as to the "new physical, chemical or biological properties" by providing the examples which include linking a fluorescent molecule or an enzyme to the functional group attached to the surface of the carbon nanotube(s).

However, the Specification gives no further description of a what, specifically, the "new physical, chemical or biological properties" are. The skilled artisan cannot readily envision the chemical structure of the claimed "effective group(s)" which "can confer new physical, chemical or biological properties to the carbon nanotube which carries it."

As such the instant claims cited above lack adequate written description of --P is an

effective group-- as recited in claim 31. Claim 32 depends from and does nothing to correct the indefiniteness of claim 31.

Response to Arguments:

Applicant's arguments filed 08/05/2009 have been fully considered but they are not persuasive.

Applicant's argument that a person having ordinary skill in the art would have understood the new properties and all the variations which may be implicitly taught but not explicitly written, is not convincing because the instant application fails to disclose a correlation between the required function (e.g. spectroscopic detection or liable to induce a biological effect) and the structure (e.g. the effective group P). The instant specification discloses

[0050] P is an effective group allowing spectroscopic detection of said functionalized carbon nanotube, such as a fluorophore, such as FITC, or an active molecule, liable to induce a biological effect, such as an amino acid, a peptide, a pseudopeptide, a protein, such as an enzyme or an antibody, a nucleic acid, a carbohydrate, or a drug,

And further discloses:

[0063] The expression "P is an effective group" means that P is a group which can confer new physical, chemical or biological properties to the carbon nanotube which carries it.

However, for the purpose of written description the analysis is what is now claimed. Vas-Cath Inc. V. Mahurka, 19 USPQ2d 1111, states that applicant must convey with reasonable clarity to those skilled in the art that, as of the filing date sought, he or she

was in possession of the invention. *The invention, for purposes of the written description inquiry, is whatever is now claimed* [emphasis added] (see page 1117). A review of the language of the claim(s) indicates that these claims are drawn to a carbon nanotube composition wherein the carbon nanotubes are surface functionalized. The claimed functional groups may comprise a chemical moiety "P which is an effective group allowing spectroscopic detection of said functionalized carbon nanotube, or an active molecule, liable to induce a biological effect." However, there is not recitation or guidance regarding a chemical moiety which a person having ordinary skill in the art would recognize as "allowing spectroscopic detection" or "liable to induce a biological effect." And because of the lack of recitation of any chemical moiety a person having ordinary skill cannot envisage a structure which predictably results in the function.i.e., a structure to function relationship. "An adequate written description of a chemical invention also requires a precise definition, such as by structure, formula, chemical name, or physical properties, and not merely a wish or plan for obtaining the chemical invention claimed. See, e.g., Univ. of Rochester v. G.D. Searle & Co., 358 F.3d 916, 927, 69 USPQ2d 1886, 1894-95 (Fed. Cir. 2004)" (MPEP § 2105 - II - a; § 2163). Therefore claims 31 and 32, as currently recited, lack adequate written description of the limitation "P is an effective group."

- 1. Claims 31 and 32 remain rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable**

one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Specifically the --effective group-- as recited in claim 31 lacks enablement as to how to make and use the claimed invention.

The factors to be considered in determining whether a disclosure meets the enablement requirement of 35 U.S.C. 112, first paragraph, have been described in *In re Wands*, 8 USPQ2d1400 (Fed. Cir. 1988). Among these factors are: 1) scope or breadth of the claims; 2) nature of the invention; 3) relative level of skill possessed by one of ordinary skill in the art; 4) state of, or the amount of knowledge in, the prior art; 5) level or degree of predictability, or a lack thereof, in the art; 6) amount of guidance or direction provided by the inventor; 7) presence or absence of working examples; and 8) quantity of experimentation required to make and use the claimed invention based upon the content of the supporting disclosure.

Scope or breadth of the claims

Applicant's claim a broad genus of surface functionalized carbon nanotube(s) where the functional group(s) attached to the surface of the carbon nanotube(s) which may comprise an effective group (P).

Nature of the Invention

Applicant's claimed invention relates to the field of nanostructured carbon materials, specifically surface functionalized carbon nanotubes. The invention is drawn to carbon nanotubes comprising surface functional group(s) wherein the group(s) are capping and/or protecting groups which may be replaced with another chemical group(s) by a relatively simple chemical reaction. The claimed invention therefore provides carbon nanotube(s) which can be simply reacted to provide various surface functional groups at the preference of the skilled artisan.

Relative level of skill possessed by one of ordinary skill in the art

The level of skill in the art is high usually requiring a Masters degree or Doctorate to work in the field. Group leaders would be expected to have a Doctorate degree with several year of experience and an established expertise in the art.

State of, or the amount of knowledge in, the prior art

The amount of knowledge in the prior art is relatively low. While carbon nanotubes are well known in the chemical arts and the structure and properties of carbon nanotubes are well elucidated, the chemistry of surface functionalization is a relatively immature art. Georgkilas et al. teach, "only limited methods have been reported in the literature providing functionalized nanotubes with some solubility." (AIP Conf. Proc., 2002, vol. 633, pp. 73, lines 4-6). Seifert et al. teach, "It is well known that especially the open ends of CNTs are quite reactive due to the presence of dangling bonds and, therefore, may serve as regions for functionalization...By contrast, the functionalization of the sidewalls due to the aromatic-like bonding nature might be hard to realize, but would open avenues for modification of the intrinsic tube properties." (Applied Physics Letters, vol. 77, No. 9, pp. 1313, 1:7-13). Bahr et al. teach, "At first glance, judging from the number of reported reaction types..., the covalent chemistry of SWNTs is not particularly rich." (Journal of Materials Chemistry, 2002, vol. 12, p. 1952, 1:47-49).

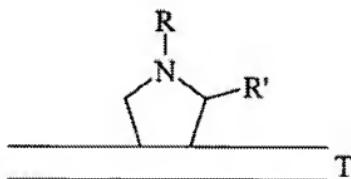
Level or degree of predictability, or lack there of, in the art

The level of predictability in the art is relatively high. The art relies on the chemistry of materials with regards to the carbon nanotubes and the chemical arts with

regards to surface functionalization of the carbon nanotubes. The predictability of each of these field is relatively high. With regards to medical applications of functionalized carbon nanotubes the degree of predictability is low, however, as the interaction of such nanostructures with biological systems is not well understood.

Amount of guidance or direction provided by the inventor

The inventor provides guidance on the surfaces functionalization of carbon nanotubes. The surface functionalization begins with 1,3-dipolar addition of azomethine ylides resulting in a pyrrolidine ring attached to the surface of the carbon nanotube:



The inventor further provides various chemical groups which could be substituted in the R and/or R' positions of the pyrrolidine ring surface group. The guidance provided by the inventor is not commensurate in scope with the broad genus of the claimed invention.

Presence or absence of working examples

The inventors provide 10 working examples resulting in 11 unique functionalized carbon nanotube compositions. However, 8 of the 11 unique functionalized carbon nanotube compositions are derived from further functionalization of one of the other

functionalized carbon nanotubes. Furthermore each of the working examples relies on the 1,3-dipolar addition of azomethine ylide reaction as a starting point, which is not commensurate in scope with at least the first 5 claims of the instantly claimed invention.

Quantity of experimentation required to make and use the invention

The quantity of experimentation required to make and use the invention, as claimed is undue because the state of knowledge in the prior art is relatively low and the guidance and working examples provided by the inventors in the specification is not commensurate in scope with the instantly claimed invention. Therefore the skilled artisan would be burdened with undue experimentation when tasked with finding the --effective group(s)-- of the instantly claimed invention.

In conclusion, claims 31 and 32 are rejected in light of the relatively low amount of knowledge in the prior art and, the limited guidance and/or working examples provided by the inventors in the specification.

Response to Arguments:

Applicant's arguments filed 08/05/2009 have been fully considered but they are not persuasive.

Applicant's argument that a person having ordinary skill in the art would have known the kinds of groups which allow spectroscopic detection and would have been able to identify the potential target for interaction with the target is not convincing because the instant specification discloses that:

[0063] The expression "P is an effective group" means that P is a group which can confer new physical, chemical or biological properties to the carbon nanotube which carries it.

And "new physical, chemical or biological properties" would not have been reasonably limited to "spectroscopic detection" and/or "interaction with biological components." A person having ordinary skill in the art would have to synthesize carbon nanotubes and develop a method for substituting the surface with chemical moieties. In order to determine what a new biological property would have been conferred a protocol would have to be established in order to determine how a change could be effected. In order to determine what new spectroscopic property would have been conferred a protocol would have to be established in order to determine how a change could be effected. Therefore, the quantity of experimentation required to make and use the invention, as claimed is undue.

Claim Rejections - 35 U.S.C. 112 - Second Paragraph

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

1. **Claims 29-32 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.**
2. Claims 31 and 32 are rejected for being indefinite because claim 31 recites -- effective group--. The instant specification discloses, "The expression "P is an effective

group" means that P is a group which can confer new physical, chemical or biological properties to the carbon nanotube which carries it." It is unclear what exactly the metes and bounds of effective groups are. Claim 32 is rejected because it depends from and does nothing to correct the indefiniteness of claim 31.

3. Claims 31 and 32 are rejected as being indefinite because claim 31 recites "derived from a reactive group." The instant specification discloses, "The expression 'Y is derived from a reactive group' means that Y is a heteroatom or a functional group which has been modified by a chemical reaction generating a new covalent bond." (p. 7, lines 11-13). The 11th edition of the Merriam-Webster's Collegiate Dictionary (Merriam-Webster Incorporated: Springfield, Massachusetts, 1993, pp 311) defines "derivative" as, "a chemical substance related structurally to another substance and theoretically derivable from it." For example, carbon dioxide could theoretically be derived from the combustion of a carbon nanotube. Therefore, the definition of derivative in the Merriam-Webster Collegiate Dictionary does not shed light on what Applicants' intended for the meaning of "derived from a reactive group." It remains unclear what exactly the metes and bounds of "derived from a reactive group" are. Claim 32 is rejected because it depends from and does nothing to correct the indefiniteness of claim 31.

4. Claims 31 and 32 are rejected as being indefinite because claim 31 recites "liable to be linked to." The instant specification does not define "liable to be linked to" and it is unclear what the metes and bound of this expression should be. Claim 32 is rejected because it depends from and does nothing to correct the indefiniteness of claim 31.

Response to Arguments:

Applicant's arguments filed 08/05/2009 have been fully considered but they are not persuasive.

Applicant's argument that a person having ordinary skill in the art would have understood that the expression "P is an effective group" [means that] P is a molecule having spectroscopic or biological properties, is not convincing because all molecules have "spectroscopic properties" and most molecules have "biological properties." It is completely unclear what properties are considered to fall within a "spectroscopic property" or a "biologic property" and what properties are excluded, since everything could arguably be considered to have one or both of these properties. Therefore, because the metes and bounds of the recited limitations "liable to be linked to" and "spectroscopic detection" are unknown, the limitation "P is an effective group" is similarly deficient. And the claims are not reasonably limited to the disclosure in the instant specification of "spectroscopic techniques, such as fluorescence microscopy, or nuclear magnetic resonance or FTIR [...] spectroscopy." ([0064], as published). Therefore, applicant's remarks do nothing to shed light on the metes and bound of the claimed limitation "P is an effective group."

Applicant's argument that a person having ordinary skill in the art would have understood that a Y group is the group remaining after the chemical reaction of a reactive group is not convincing in view of the dictionary definition of "derivative," as discussed above.

Applicant's argument that a person having ordinary skill in the art would have understood that "liable to be linked to" refers to the possibility to create a chemical bond

is not convincing because the broadest reasonable interpretation of "linked to" does not require a chemical bond, for example DNA chains are linked together by hydrogen bonds which are not covalent bonds. Therefore the argument that "liable to be linked to" refers to the possibility to create a chemical bond does nothing to shed light on the metes and bounds of the recited claim.

Claim Rejections - 35 U.S.C. 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

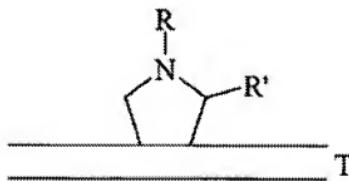
- (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
- (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

1. Claims 27-32 and 45 remain, and 54 is, rejected under 35 U.S.C. 102(a) as being anticipated by Georgakilas et al. (Chemical Communications, 2002, pp. 3050 - 3051).

Applicant claims

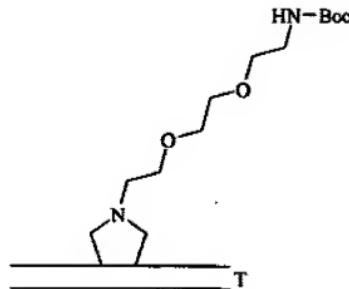
Applicant claims a functionalized carbon nanotube, the surface of which carries covalently bound reactive and/or activatable functional groups which are homogenously distributed on said surface, said functionalized carbon nanotube being substantially intact and soluble in organic and/or aqueous solvents. Applicant further claims the functionalized carbon nanotube wherein the carbon nanotube is a single-walled (SWNT) or multi-walled (MWNT) carbon nanotube. Applicant further claims a functionalized

carbon nanotube wherein organic solvents are selected from dimethylformamide, dichloromethane, chloroform, acetonitrile, dimethylsulfoxide, methanol, ethanol, toluene, isopropanol, 1,2-dichloroethane, N-methylpyrrolidone, or tetrahydrofuran. Applicant further claims the functionalized carbon nanotube of the general formula $[C_n]_X_m$ wherein C_n are carbons of a substantially cylindrical carbon nanotube of substantially constant diameter and X represents one of several functional groups. Applicant further claims various functional groups attached to the surface of carbon the claimed carbon nanotubes via substituted pyrrolidine rings:



where (T) represents the carbon nanotube.

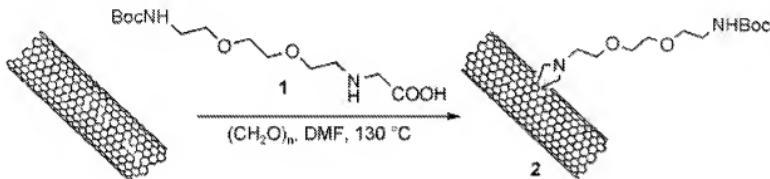
Applicant further claims the species:



in claim 32.

Disclosure of the Prior Art

Georgakilas et al. disclose the solubilisation in aqueous media of side-wall chemically modified, full length SWNTs and MWNTs and their derivitisation with N-protected amino acids (p. 3050, col. 1, lines 39-41). Georgakilas et al. further disclose the chemically functionalized carbon nanotube:



which is dissolved in dimethylformamide (DMF) (p. 3050, col. 2, Scheme 1).

Response to Arguments:

Applicant's arguments filed 08/05/2009 have been fully considered but they are not persuasive.

Applicant's assertion that the cited reference is not "by others" is acknowledged. However, according to MPEP § 2132-II:

The term "others" in 35 U.S.C. 102(a) refers to any entity which is different from the inventive entity. The entity need only differ by one person to be "by others."

And the authorship of the cited reference is different from the inventive entity of the instant application, therefore the rejection is maintained.

2. Claims 27-31 remain, and new claim 54 is, rejected under 35 U.S.C. 102(b) as being anticipated by Georgakilas et al. (Journal of the American Chemical Society, vol. 124, No. 5, pp. 760-761).

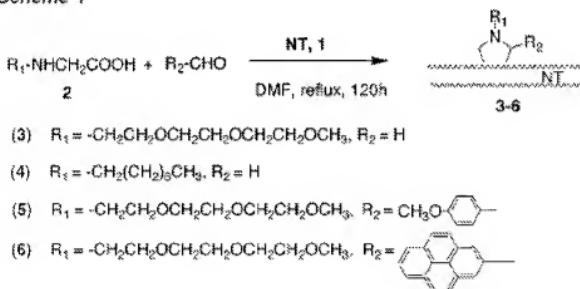
Applicant claims

Applicant claims a functionalized carbon nanotube, the surface of which carries covalently bound reactive and/or activatable functional groups which are homogenously distributed on said surface, as discussed above.

Disclosure of the Prior Art

Georgakilas et al. disclose their approach to carbon nanotube functionalization, which works for SWNTs and MWNTs, has lead to a high level of solubility of the resulting products (p. 760, 1:13-17). Georgakilas et al. further disclose, their functionalization methodology is based on 1,3-dipolar cycloaddition of azomethine ylides, generated by condensation of an α -amino acid and an aldehyde (p. 760, 1:26-28). Georgakilas et al. further disclose the SWNTs were suspended in DMF, together with excess aldehyde and modified glycine...the heterogenous reaction mixture was heated to 130 C for 5 days...giving a brown solid which was very soluble in $CHCl_3$, CH_2Cl_2 , acetone, methanol, ethanol, and also water (p. 760, 1:30-36). Georgakilas et al. further disclose the reaction products of scheme 1:

Scheme 1



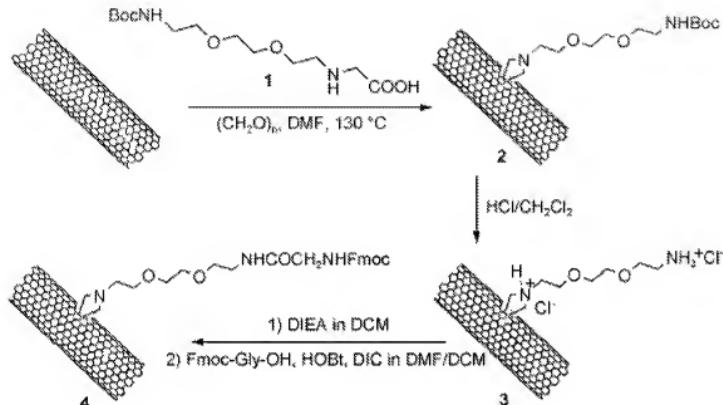
Which reads on the claimed genus where, M is $-(CH_2)_r$ or $-(CH_2-CH_2-O)_r-CH_2CH_2-$, and Y is a reactive group when $a=b=0$ or at least one of Y, Z, or P groups, can be substituted by a capping group. Georgakilas et al. further disclose their results were successful with the use of either short oxidized or long nonoxidized SWNTs without notable differences in their solubility and yields of between 20 and 80% (p. 761, 1:15-17).

Response to Arguments:

Applicant's arguments filed 08/05/2009 have been fully considered but they are not persuasive.

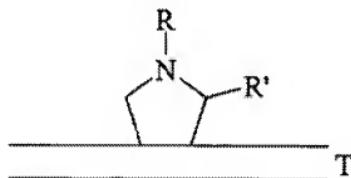
Applicant has not argued any of the limitations of claims 27-30. Applicant's failure to address any of the limitations of claims 27-30 is taken as yielding to the anticipation of those claims by Georgakilas et al. (Journal of the American Chemical Society, vol. 124, No. 5, pp. 760-761).

Applicant's argument that GEORGAKILAS et al. (JACS 2002) does not disclose carbon nanotubes carrying covalently bound reactive and/or activable groups is not convincing because GEORGAKILAS et al. (JACS 2002) discloses the reaction scheme:



Scheme 1

which clearly indicates the reactive group tert-butyloxycarbonyl (Boc) attached to a spacer group. Furthermore, claim 31 recites the formula (I) as follows:



[0051] if appropriate at least one of Y, Z, or P groups, can be substituted by a capping group, such as CH₃CO— (acetyl), methyl, or ethyl, or a protecting group such as methyl, ethyl, benzyl, tert-butyl, trityl, 3-nitro-2-pyridylsulfonyl, tert-butyloxycarbonyl (Boc), fluorenylmethyloxycarbonyl (Fmoc), benzylcarbonyl, trimethylsilylethyoxy carbonyl, phthalimide, dimethylacetal, diethylacetal, or 1,3-dioxolane.

Therefore the claim is anticipated by GEORGAKILAS et al. (JACS 2002).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the

examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

1. Claims 32, 45 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Georgakilas et al. (Journal of the American Chemical Society, vol. 124, No. 5, pp. 760-761).

Applicants Claims

Applicant claims a functionalize carbon nanotube comprising a surface having homogeneously distributed covalently bound reactive and/or activable functional groups, wherein said functionalized carbon nanotube is substantially intact and soluble in organic and/or aqueous solvents.

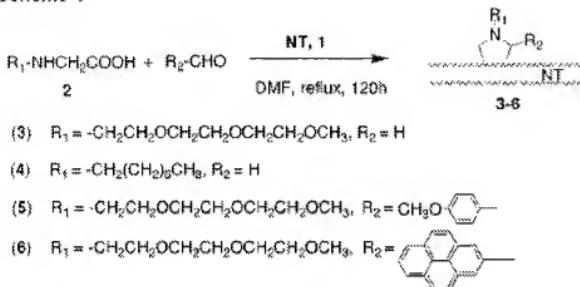
Determination of the scope

and content of the prior art (MPEP 2141.01)

Georgakilas et al. teaches their approach to carbon nanotube functionalization, which works for SWNTs and MWNTs, has lead to a high level of solubility of the resulting products, as discussed above (p. 760, 1:13-17). Georgakilas et al. further teaches the SWNTs were suspended in DMF, together with excess aldehyde and modified glycine...the heterogenous reaction mixture was heated to 130 C for 5 days...giving a brown solid which was very soluble in CHCl₃, CH₂Cl₂, acetone, methanol, ethanol, and also water (p. 760, 1:30-36).

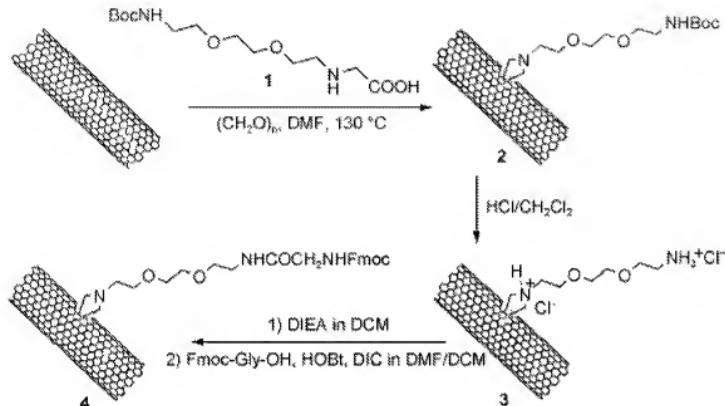
Georgakilas et al. disclose the reaction products of scheme 1:

Scheme 1



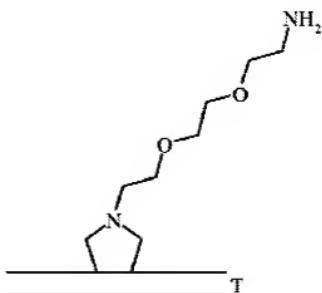
Which reads on the claimed genus where, M is -(CH₂)_r or -(CH₂-CH₂-O)_r-CH₂CH₂-_r and Y is a reactive group when a=b=0 or at least one of Y, Z, or P groups, can be substituted by a capping group. Georgakilas et al. further teaches their results were successful with the use of either short oxidized or long nonoxidized SWNTs without notable differences in their solubility and yields of between 20 and 80% (p. 761, 1:15-17).

Georgakilas et al. disclose the scheme:



Scheme 1

wherein the functionalized nanotube of step 3 is the protonated version of the functionalized nanotube, [-M-Y-(Z)_a-(P)_b], wherein a=b=0, M is (CH₂CH₂O)_r--CH₂CH₂ where r=2, and Y is -NH₂ as recited in the Markush groups of claims 32, 45 and 53 (as depicted below):



The difference between the functionalized nanotube of step 3 above is that the nanotube is protonated. It would have been *prima facie* obvious to one of ordinary skill

in the art at the time the claimed invention was made to deprotonate the functionalized carbon nanotube depicted is step 3 of Scheme 1 (above) and arrive at the claimed carbon nanotube because the deprotonated version would have an increased solubility in organic solvents. One of ordinary skill in the art would have been motivated to XXX because the increased solubility in organic solvents would have provided a suitable route to further functionalization by reaction with the reactive -NH₂ group.

From the teachings of the references, it is apparent that one of ordinary skill in the art would have had a reasonable expectation of success in producing the claimed invention. Therefore, the invention as a whole would have been *prima facie* obvious to one of ordinary skill in the art at the time the invention was made, as evidenced by the references, especially in the absence of evidence to the contrary.

In light of the forgoing discussion, the Examiner concludes that the subject matter defined by the instant claims would have been obvious within the meaning of 35 USC 103(a).

Double Patenting

A rejection based on double patenting of the "same invention" type finds its support in the language of 35 U.S.C. 101 which states that "whoever invents or discovers any new and useful process ... may obtain a patent therefor ..." (Emphasis added). Thus, the term "same invention," in this context, means an invention drawn to identical subject matter. See *Miller v. Eagle Mfg. Co.*, 151 U.S. 186 (1894); *In re Ockert*, 245 F.2d 467, 114 USPQ 330 (CCPA 1957); and *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970).

A statutory type (35 U.S.C. 101) double patenting rejection can be overcome by canceling or amending the conflicting claims so they are no longer coextensive in scope. The filing of a terminal disclaimer cannot overcome a double patenting rejection based upon 35 U.S.C. 101.

1. **Claims 27-29 remain provisionally rejected under 35 U.S.C. 101 as claiming the same invention as that of claims 1-3 and 25 of copending Application No. 11/249,328. This is a provisional double patenting rejection since the conflicting claims have not in fact been patented.**

2. Claims 27-29 and 45 of this application conflict with claims 1-3 and 25 of Application No. 11/249,328. 37 CFR 1.78(b) provides that when two or more applications filed by the same applicant contain conflicting claims, elimination of such claims from all but one application may be required in the absence of good and sufficient reason for their retention during pendency in more than one application. Applicant is required to either cancel the conflicting claims from all but one application or maintain a clear line of demarcation between the applications. See MPEP § 822.

Response to Arguments:

Applicant's arguments filed 08/05/2009 have been fully considered but they are not persuasive.

Applicant's assertion that the claims have been modified to overcome this rejection is acknowledged, however, the scope of the instantly rejected claims remains the same.

Nonstatutory Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140

F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

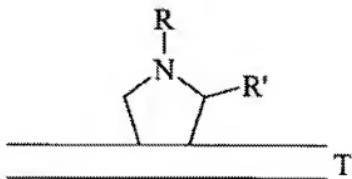
Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

1. Claims 30-32 remain provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 4, 7 and 9 of copending Application No. 11/249,328 (hereafter '328).

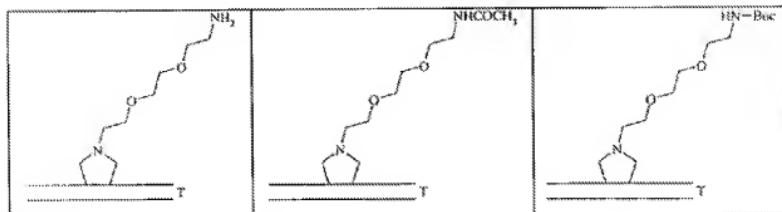
Although the conflicting claims are not identical, they are not patentably distinct from each other because the copending claims are substantially coextensive in scope with the instant rejected claims.

Instant claim 30 recites, a functionalized carbon nanotube according to claim 3, of the following general formula $[C_n]-X_m$ wherein C_n are surface carbons of a substantially cylindrical carbon nanotube of substantially constant diameter, said diameter being from about 0.5 to about 50 nm, in particular from about 0.5 to 5 nm for SWNTs and from about 20 to about 50 nm for MWNTs, X is a functional group, identical, n is an integer from about 3.10^3 to about 3.10^6 , m is an integer from about 0.001n to about 0.1n, there are from about 2.10^{11} moles to about 2.10^9 moles of X functional groups per cm^2 of carbon nanotube surface. Instant claim 31 recites, a functionalized carbon nanotube according to claim 4, wherein X represents one or

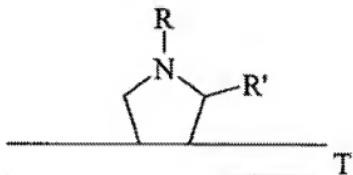
several substituted pyrrolidine rings, identical or different, of the following general formula (I):



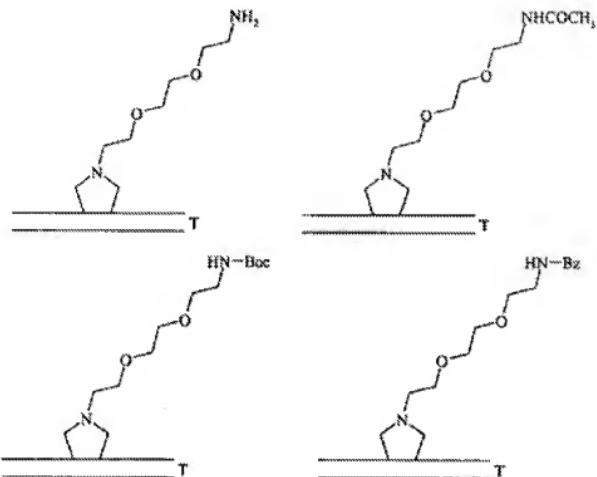
wherein T represents a carbon nanotube, and independently from each other R and R' represent -H or a group of formula $-M-Y-(Z)_a-(P)_b$, wherein a represents 0 or 1 and b represents an integer from 0 to 8, preferably 0, 1, or 2, P representing identical or different groups when b is greater than 1, provided R and R' Cannot simultaneously represent H. The variables of M, Y, Z and P are substantially coextensive in scope, the difference being that in the instant claim more species structures are claimed for the Z group. Instant claim 32 recites, a functionalized carbon nanotube according to claim 31, wherein $a=b=0$ and Y is a reactive group selected from the list comprising -OH, -NHE, -COOH, -SH, -CHO, a ketone, such as -COCH₃, an azide, or a halide, in particular -NH₂, said functionalized carbon nanotube being, if appropriate, substituted by a capping or a protecting group, in particular a Bz, Boc or acetyl group, and being for instance a functionalized carbon nanotube of one of the following formulae:



Copending '328 claim 4 recites, a functionalized carbon nanotube according to claim 3, of the following general formula $[C_n]_X_m$ wherein C_n are surface carbons of a substantially cylindrical carbon nanotube of substantially constant diameter, said diameter being from about 0.5 to about 50 nm, in particular from about 0.5 to 5 nm for SWNTs and from about 20 to about 50 nm for MWNTs, X represents one of several functional groups, identical or different, each functional group comprising at least one effective group, n is an integer from about 3.10^3 to about 3.10^6 , m is an integer from about $0.001n$ to about $0.1n$, there are from about 2.10^{-11} moles to about 2.10^{-9} moles of X functional groups per cm^2 of carbon nanotube surface. Copending '328 claim 7 recites, a functionalized carbon nanotube according to claim 4, wherein X represents one or several substituted pyrrolidine rings, identical or different, of the following general formula (I):



wherein T represents a carbon nanotube, and independently from each other R and R' represent -H or a group of formula -M-Y-(Z)_a-(P)_b, wherein a represents 0 or 1 and b represents an integer from 0 to 8, preferably 0, 1, or 2, P representing identical or different groups when b is greater than 1, provided R and R' Cannot simultaneously represent H. The variables of M, Y, Z and P are substantially coextensive in scope, the difference being that in the instant claim more species structures are claimed for the Z group. Copending '328 claim 9 recites, a functionalized carbon nanotube according to claim 7, wherein a=b=0 and Y is a reactive group selected from the list comprising -OH, -NHE, -COOH, -SH, -CHO, a ketone, such as -COCH₃, an azide, or a halide, in particular -NH₂, said functionalized carbon nanotube being, if appropriate, substituted by a capping or a protecting group, in particular a Bz, Boc or acetyl group, and being for instance a functionalized carbon nanotube of one of the following formulae:



The difference between the rejected claims and the claims of copending '328 is that copending claim 4 has the limitation that each X can be identical or different.

It would have been obvious to one of ordinary skill in the art at the time the claimed invention was made that the instant claims are an obvious variant of the claims of copending '328 because the skilled artisan would recognize and have a reasonable expectation of success that each X could be the same or different, especially in the absence of evidence to the contrary.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Response to Arguments:

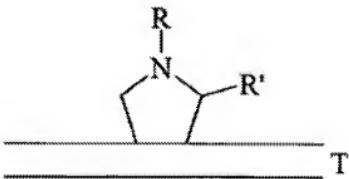
Applicant's arguments filed 08/05/2009 have been fully considered but they are not persuasive.

Applicant's argument that the claims of copending '328 recite "several effective groups (P groups)," which are distinguished from the present claims as they recite "0 or 1 effective group (P group)" is acknowledged, however, the scope of the instantly rejected claims remains obvious because in the claims of copending '328 the word "several" occurs only in reference "X groups" where copending '328 recites "X represents one or several functional groups" (claim 4, page 5, line 9). And instant claim 30 recites "X is a functional group" which does not sufficiently distinguish the claim(s).

2. Claims 30 and 31 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 34 and 36 of copending Application No. 11/628,749 (hereafter '749).

Although the conflicting claims are not identical, they are not patentably distinct from each other because the copending claims are substantially coextensive in scope with the instant rejected claims.

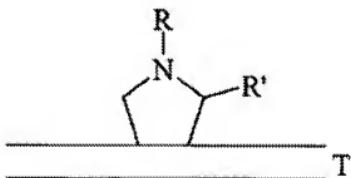
Instant claim 30 recites a functionalized carbon nanotube according to claim 3, of the following general formula $[C_n]-X_m$ wherein C_n are surface carbons of a substantially cylindrical carbon nanotube of substantially constant diameter, said diameter being from about 0.5 to about 50 nm, in particular from about 0.5 to 5 nm for SWNTs and from about 20 to about 50 nm for MWNTs, X is a functional group, n is an integer from about $3 \cdot 10^3$ to about 3.10^6 , m is an integer from about 0.001n to about 0.1n, there are from about $2 \cdot 10^{-11}$ moles to about $2 \cdot 10^{-9}$ moles of X functional groups per cm^2 of carbon nanotube surface. Instant claim 31 recites, a functionalized carbon nanotube according to claim 30, wherein X is a pyrrolidine ring, of the following general formula (I):



wherein T represents a carbon nanotube, and independently from each other R and R' represent -H or a group of formula -M-Y-(Z)_a-(P)_b, wherein independently from each other (a) and (b) represent 0 or 1, provided R and R' Cannot simultaneously represent H. The variables of M, Y, Z and P are substantially coextensive in scope, the difference being that in the instant claim more species structures are claimed for the Z group.

Copending '749 claim 26 recites, a complex comprising a carbon nanotube comprising positive or negative charges, said charges being carried by at least one charge-carrying group, said charge-carrying group being covalently bound to the surface of said carbon nanotube, and at least one charged molecule, said charged molecule comprising at least one negative charge if said carbon nanotube comprises positive charges or at least one positive charge if said carbon nanotube comprises negative charges, provided that the charged molecule is different from Cl- and TFA-, the bond between the carbon nanotube and the charged molecule being essentially electrostatic. Copending claim 34 recites, the complex according to claim 26, wherein the carbon nanotube corresponds to the following general formula [C_n]-X_m wherein C_n are surface carbons of a substantially cylindrical carbon nanotube of substantially constant diameter, said diameter being from about 0.5 to about 50 nm, for SWNT and

from 20 to about 50 nm for MWNT, X represents one of several functional groups, identical or different, provided that at least one of the X groups comprises at least one charge carrying group, n is an integer from 3×10^3 to 3×10^6 , m is an integer from 0.001n to 0.1n, there are from 2×10^{-11} moles to 2×10^{-9} moles of X functional groups per cm^2 of carbon nanotube surface. Copending claim 36 recites, the complex according to claim 34, wherein X represents one or several substituted pyrrolidine rings, identical or different, provided that at least one of said substituted pyrrolidine rings is substituted by at least one charge-carrying group, of the following general formula (I) :



wherein T represents a carbon nanotube, and independently from each other R and R' represent -H or a group of formula -M-Y-(Z)_a-(P)_b, wherein (a) represents 0 or 1 and (b) represents an integer from 0 to 8, preferably 0, 1, or 2, P representing identical or different groups when b is greater than 1, provided R and R' cannot simultaneously represent H. The variables of M, Y, Z and P are substantially coextensive in scope, the difference being that copending claim 36 includes the limitation that said group optionally include charged group(s).

The difference between the rejected claims and the claims of copending '749 is that the claim of '749 include a charge carrying group.

It would have been obvious to one of ordinary skill in the art at the time the claimed invention was made that the instant claims are an obvious variant of the claims of copending '749 because the skilled artisan would recognize and have a reasonable expectation of success that X could be a charge carrying group. The skilled artisan would have been motivate to prepare the salt of the functionalized carbon nanotube in order to increase the aqueous solubility and may increase the storage stability.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Response to Arguments:

Applicant's arguments filed 08/05/2009 have been fully considered but they are not persuasive.

Applicant's assertion that the claims have been modified to overcome this rejection is acknowledged, however, the scope of instant claim 30 and copending '749 claim 34 remains the same. The scope of instant claim 31 has been narrowed, however, the remaining limitations are still recited in copending '749 claim 36.

Conclusion

Claims 27-32, 45, 53 and 54 have been examined on the merits. The specification is objected; claim 45 is objected; claims 31 and 32 are rejected under U.S.C 112 first paragraph based on written description and enablement requirements; claims 29-32 are rejected under U.S.C. 112 second paragraph; claims 27-32, 45 and 54 are rejected under U.S.C. 102(a) and U.S.C. 102(b); claims 32, 45 and 53 are rejected under 35 U.S.C. 103(a); claims 27-32 are provisionally rejected for statutory double

patenting over copending 11/249,328. Claim(s) are rejected on the ground of nonstatutory double patenting over copending applications 11/249,328 and 11/628,749.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to IVAN GREENE whose telephone number is (571)270-5868. The examiner can normally be reached on Monday through Thursday 7AM to 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bonnie Eyler can be reached on (571) 272-0871. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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